

AUSTRALIAN BLEPHAROCERIDAE.

Corrections and Additions to Parts I. and II.

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(Communicated by Dr. R. J. Tillyard.)

When studying the pupa of *Edwardsina* in the process of formation under the larval skin, I assumed that a transformation of the breathing filaments into lamellae was taking place (this Journal, Vol. III., p. 54), although I had not seen the intermediate stages. This process, however, was never quite clear to my mind, and I was therefore anxious to find the intermediate stages of this transformation. So, when I was in Sydney recently, I was glad to see in Mr. Nicholson's collection a fair number of *Edwardsina* larvae that he had collected at the same time and on the same spots as Dr. Tillyard on Mt. Kosciusko. He very willingly gave me this material for study, for which loan I am very much indebted to him as it led me to see the error I had made and which I intend to correct in this paper.

Among these larvae I found one specimen, within which a pupa was in formation, and this pupa presented breathing organs with perfectly well-formed lamellae, a case that I had looked for in vain in Dr. Tillyard's material; but a close comparison with a larva in which the pupa in formation presented only filaments as breathing organs, showed me that in reality I had to deal with two different species of *Edwardsina*, however faint were the characters of distinction between them.

I then referred to the imagines of Dr. Tillyard's collection and saw that in fact two species of *Edwardsina* had been described by him under the name of *E. australiensis*. This mistake occurred because he took to make his mounts a specimen preserved in spirit and collected on the last day of his sojourn on Mt. Kosciusko in a spot lower down Digger's Creek, and not one of the numerous specimens collected higher up on the previous days, and which happened to belong to another species.

As this mounted specimen served for the description of most of the morphological features of *E. australiensis*, it has to be considered as the type. I give hereafter the alterations that have to be made to this description, and, at the same time, the description of the new species with its larva that I have the pleasure to dedicate to Dr. Tillyard, its discoverer.

The correction to be brought to the description of the early stages consists only in a change of name. The pupa described and figured, p. 53, is the one of *E. tillyardi* instead of *E. australiensis*, but on the other hand, the different stages of the larva described have in all probability to remain under the name of *E. australiensis*, although a pupa with breathing filaments has not been found up to now which would give us a definite proof of it. It is a most curious fact that of the 135 larvae collected by Dr. Tillyard and Mr. Nicholson, only a single one belongs to the same species as the 95 pupae found at the same time on the same

rock, and that none of the pupae are to be referred to the same species as the other 134 larvae. This shows how careful one must be in working out the life-history of organisms which, by their mode of living, are not adapted to be reared in the laboratory.

However, in spite of this error of identity, none of my conclusions regarding the early stages of the Blepharoceridae have to be altered in any way, because even if the presumed larva of *E. australiensis* proved to belong to some other form, the larva of *E. tillyardi* hereafter described, differs so little from it that it can be taken without inconvenience to base these conclusions upon.

I also take this opportunity to describe the larva of *Neocurupira nicholsoni* Till., that Mr. Nicholson found in great quantity this year on Mt. Kosciusko, together with their corresponding pupae, in which the imago of this species could be identified with certainty.

It is remarkable to find that in this same creek on Mt. Kosciusko four different species of Blepharoceridae live together, i.e., *Edwardsina australiensis* Till., *E. tillyardi*, n.sp., *Neocurupira nicholsoni* Till., and *Apistomyia tonnoiri* Till.; it is therefore probable that many more species of this interesting family remain to be discovered in Australia. I found last summer in Tasmania half a dozen species of Blepharoceridae which all belong to the genus *Edwardsina*, and none of them is to be referred to the two forms known hitherto from the mainland.

Edwardsina australiensis, Till.

Imago. The dimensions given in the description, with the exception of those of the legs, are those of the next species.

The measurements of the type are:—♂, wing, 8.5 mm., total expanse, 18 mm., body, 4 mm.

Coloration.—Head with its appendages dark, only the two first joints of the antennae slightly testaceous; posterior border of the eyes with a greyish seam. Mesonotum blackish brown, slightly shining and with greyish reflection in some positions; its sides somewhat testaceous, chiefly and more extensively above base of the wings and on the middle in front of the scutellum, which is light brown; metanotum a little lighter; pleurae also testaceous, but sternum darker. Legs light brown, all coxae completely and base of femora testaceous; wings not infuscated; stem of halteres extensively rufous, knob dark. Abdomen dull brown.

The apical spur is absent on the middle tibiae and not on the anterior ones as stated by Dr. Tillyard by a lapsus calami (0.1.1. instead of 1.0.1.). The wing figured (fig. 1a, p. 162) does not belong to *E. australiensis*; because in this species the stem of R_{3+4} is less than a third of the length of R_3 , and not half of it; the first part of R_3 is more curved downwards and a little more converging towards the end of R_2 ; the general shape of the wing is relatively broader, otherwise all other details of venation are correct.

The figs. 4a. and b. of Dr. Tillyard do not convey a right idea of the structure of the hypopygium; I give therefore a more accurate drawing beside the corresponding part of the next species for comparison.

The claspers are relatively long, not broader at base and with a blunt extremity; the penis is trifid, the titillators on the side are absent.

♀. The length of the wing is only 10.5 mm. The eyes are smaller than in the male, but not to the extent shown in Dr. Tillyard's figs. 2a. and b., which are to be referred to the following species; in this one the occiput is only half as wide as the eye and its lower swelling much less marked.

This species was not very abundant at the time of the year it was secured; only 18 specimens have been collected.

Larva.—The larva presumed as being the one of *E. australiensis* and described by me under that name, does not possess more than 4 instars, because now that I have studied more larval forms of this family I have come to the conclusion that a different shape of the mandibles is not a proof of a different instar, as I will explain hereafter. Therefore my figures 3c. and d. belong to a

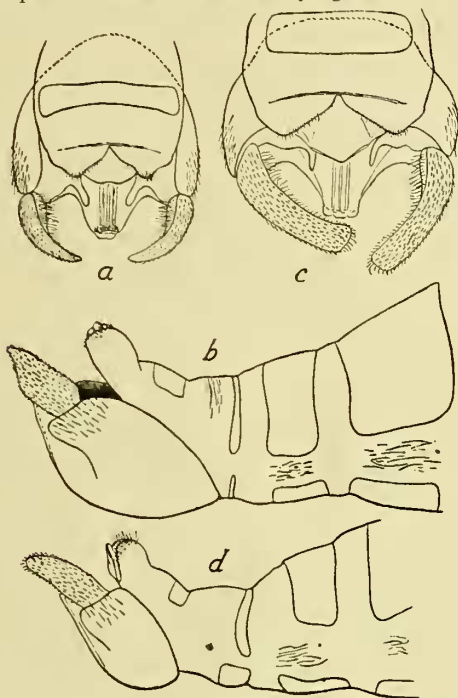


Fig. 1 a, hypopygium of *E. tillyardi* seen from above; c, the same of *E. australiensis*; b, end of abdomen of *E. tillyardi* in profile; d, the same of *E. australiensis* (these two last drawn to the same scale).

recently moulted larva in the last instar, the head of which not being fully extended on its posterior border presents a few folds that disappear when the larva reaches its full size.

Pupa.—The pupa of *E. australiensis* has not been found yet; it must be provided with breathing organs composed of tufts of filaments as shown in my fig. 1a. (p. 48) and 5h. (p. 54) made from a pupa in formation under the larval skin. The transformation of these filaments into lamellae is not probable, as I have found in Mr. Nicholson's material a larva in which the pupa was,—as one could judge by its dark colouration,—on the verge of emerging, and which presented the filaments as already described.

But if it is not true that this evolution of the filaments into lamellae takes place ontogenetically, it is at least very probable that it has taken place phylogenetically as the filamentous gill is a type much more generalised, such as we find in Simuliidae and Chironomidae pupae.

Edwardsina tillyardi, n.sp.

Very similar to *E. australiensis*; differing from it among other characters by the presence of one spur on the middle tibiae, the longer stem of R_{3+4} , the infuscated wing and the larger size.

♂. Total length, 5 mm., wing, 9.5 mm., antennae, 3 mm., legs: anterior fem. 6 mm., tib., 6, tars, 6.5; middle fem. 7 mm., tib., 5.5, tars, 6; post. fem. 9 mm.; tib., 8.5, tars, 4.

Colouration.—The head with its appendages blackish grey; the base of the antennae also dark. Mesonotum and scutellum velvety black with a greyish reflection in certain positions; side of thorax grey; metanotum and abdomen dark. Legs brown base of femora and coxae with the exception of the base of the front ones testaceous. Stem of halteres testaceous, the knob deep black. Wing uniformly infuscated.

The eyes are smaller than in *E. australiensis* and leave between them a much wider frown; seen from the side their width is not quite the double of the occiput. The relative length of the last joints of the antennae differ slightly from *australiensis*, as they increase slightly but gradually in length from the 13th on.

In the palpi the first and third joints are relatively shorter.

The labellum does not present at its forking the chitinous parts which Dr. Tillyard in his fig. 3a., of *E. australiensis*, shows erroneously as forming independent appendages and that he took to be the vestiges of the inner lobe. I do not think they can be homologised with anything else but the rod-like apodeme of the theca and its furca; at any rate, they are imbedded in the integuments of the labellum.

The wings are larger and more elongated than in *E. australiensis* and their colouring distinctly brownish; the venation is as shown by Dr. Tillyard's figure No. 1a., p. 162; the stem of R_{2+3} being about the half of R_2 ; the base of M_3 is slightly undulated. The main difference in the legs from *E. australiensis* consists in a terminal spur on the middle tibiae; the relative length of the legs is also somewhat greater. The claws of the hind legs carry 3 teeth in a series, increasing in size from the base and the smaller being preceded by a small comb of about half a dozen spines, also increasing in size from the base of the claws; this comb is also present in *E. australiensis*, but has been overlooked in the drawing by Dr. Tillyard; the claws of the other legs are similarly built, but in the middle legs the last spine of the comb is rather larger and could be taken for the first of a series of 4 teeth.

The hypopygium is as figured (fig. 1a. and h.); the claspers are relatively small and pointed at the tip; the 9th sternite is comparatively much more developed than the one of *E. australiensis* as shown by fig. 1d. and b. drawn to the same scale.

♀. Size wing, 11.5 mm.; body, 6 mm.; legs, ant. fem., 6.5 mm.; tib., 7 mm.; tars., 6.5 mm.; middle fem. 7. mm.; tib., 5.5 mm.; tars., 5.5 mm.; post fem. 9.5 mm.; tib., 9.5 mm.; tars., 4. mm.

Similar to the male but the eyes smaller, also the antennae, the last joint of which is but very little larger than the preceding one; palpi relatively shorter, the last two joints being together equal to the second, and the fourth only half the length of the third. Mandibles moderately pointed, finely ciliated on the inner edge, noticeably longer than the labellum, but not quite so long as the palpi; lacinia not larger than in the ♂, but much broader at their base where they touch each other, coming thus over the base of the labellum.

The end of the abdomen does not differ from the one of *E. australiensis*, the figure of which given by Dr. Tillyard (fig. 4c.), does not convey a right idea. I

therefore give a figure of the abdomen tip seen from below, showing the forked gonapophyses of the 9th segment.

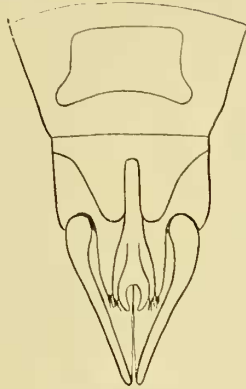


Fig. 2. End of abdomen of the female *E. australiensis* seen from below.

Larva.—The length of the full-grown larva is 9 mm., and its colour brownish without any pattern as in the supposed larva of *E. australiensis* to which it is very similar; it differs chiefly from it by the small secondary divisions being more rounded at the sides, by the constrictions on each side of the body divisions being more marked even on the last one and by the shape of the posterior end of the body, which is trilobed.

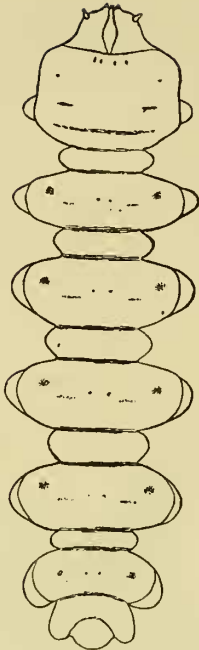
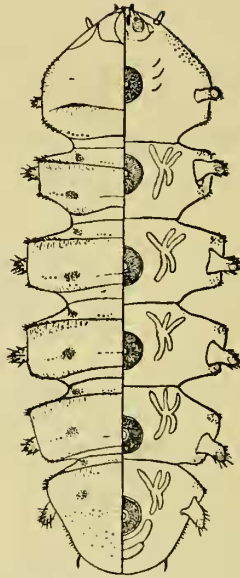
Besides there are some minor characters of differentiation such as the shape of the mandibles, which present at their distal end two very blunt teeth and are not provided with the large swollen inferior lobe. All the other mouth parts are similar to those of the larva already described, also the mentum and prementum are developed to the same extent. The head capsule widens suddenly at its posterior part and does not carry the two small dorsal processes of *E. australiensis*; the small spines in front of the thorax form only a very irregular row of four. The main divisions of the body do not carry any noticeable bristles, but besides the usual punctiform depressions they have on each side a rather deep foveole. Seen from below this larva presents the same aspect as shown in fig. 1c., p. 48, but for the three-lobed end of the body; the breathing filaments are also disposed on the small secondary divisions and form a tuft of five branches a little shorter in this species.

Pupa.—Inside the above described larva was found the pupa in formation presenting the peculiar breathing lamellae of the pupa described and figured by me under the name of *E. australiensis* (pp. 53, 54, fig. 4A.B. and fig. 5A.), and which must be referred now without any doubt to *E. tillyardi*.

Neocurupira nicholsoni, Till.

Larva.—The full-grown larva of *N. nicholsoni* is about 6 mm. long and is characterised by:—

1. The absence of any kind of lateral appendages on the 8th abdominal segment, the anal division being thus provided with only one pair of appendages.
2. The presence of rather long spines on the lateral appendages.

Fig. 3. Larva of *E. tillyardi*.Fig. 4. Larva of *N. nicholsoni*.

3. The spines on the side of the anterior and posterior borders of the main division of the body.
4. The nearly complete fusion of the 7th to 9th abdominal segments.

Its colouration is dark brown, nearly black on the dorsum, with the exception of the anterior part of the cephalic division corresponding to the thorax, which is lighter brown.

The bead is small, incomplete, because of the deeply notched lateralia on the dorsum, which do not extend ventrally, leaving thus the mouth parts without a chitinous frame behind them.

The mouth parts are similar to those of *A. tonnoiri*, the mentum is absent as is the case with all Blepharoceridae larvae so far as I know; the hard black mandibles are blunt on their biting end with no conspicuous lobe below.

The antennae are two-jointed, with the first cylindrical joint short, the second two and a half times longer, and tapering towards the end which bears a couple of sensitive cones.

The sides of the cephalic division present two groups of spinules; some numerous smaller ones immediately after the lateralia and 6 or 7 stronger ones on the posterior corner of this division; these are followed by a few smaller ones on the ventral side of the body.

The part of the cephalic division corresponding to the first abdominal segments is somewhat swollen and rugose, but does not present there any tubercules, spines or hairs, only a series of small punctiform depressions is to be seen on each side of the posterior border.

Each of the main divisions of the body is provided with an anterior and a posterior transverse ridge, but this last one is more or less obsolete towards the sides; the anterior one carries on each side of the body a row of about a dozen spines, the outer ones being the strongest, and the inner ones gradually decreasing in size toward the interior in a row containing a larger and a smaller spine alternately; the posterior corners of the main divisions bear only half a dozen spines, smaller than the anterior ones followed, as well as these by a few spinules on the ventral side of the body. The dorsum of the divisions is rather rugose, especially along the anterior ridge, where it is somewhat corrugated, chiefly on the sides; besides, each division presents in front of that ridge and on each side of the body, a well marked foveole and at some distance in front of the posterior ridge another deeper foveole containing a certain number of punctiform depressions, a series of which extends also on the external side of this foveole.

The last or anal division presents also an anterior ridge with the lateral rows of spines, and the sides of this division after the level of the lateral appendages carry a series of spinules, which ends in two much longer curved bristles, so closely adpressed against each other that they give the impressions of a single stouter bristle.

The dorsum of this division is provided with a good number of punctiform depressions, which, but for those forming the two anterior foveoles, are rather irregularly distributed; they are, however, more numerous along a very shallow and indistinct transverse depression, which seems to indicate the demarcation between the 7th and 8th abdominal segment; but no limit whatever exists between the 8th and the 9th, and the end of the body is regularly rounded.

The lateral appendages, which are testaceous, are provided with a broad base, and are more or less pointed towards the tips, when seen from above they seem to be olive-shaped; they carry besides some yellowish hair on their dorsum, an irregular number of rather strong, erect black spines about as long as the width of the appendage itself; on the appendages of the cephalic division, which are distinctly smaller than the others, the spines are also smaller and fewer in number—usually four—whereas on the other appendages there is an average of 6 spines, but their number may vary from two to seven; the last division of the body carries only one pair of appendages, which do not differ from those of the main divisions; the appendages of the 8th abdominal segment are thus completely missing, their situation is marked by the curved bristle already mentioned. The gill tufts are situated about midway between the centre of the snekers and the anterior corner of the divisions; they are composed of 5 filaments, the inner ones of which are the largest; the anal gills are normally composed of two pairs of filaments, one being twice as long as the other.

Among Mr. Nicholson's material I find two other stages of this larva that I take to be the second and third, but before describing them I have to point out a very curious fact concerning the development of the mandibles of *Blepharocerid* larvae.

When the smallest specimens of one given stage are examined, they are found to be provided with a toothed type of mandible such as shown in fig. 5a, whereas the larger specimens of the same stage present a hard, black, roundish type of mandible as shown in fig. 5b. In the next stage, again, the smaller larvae have toothed mandibles, and the larger, plain ones, and so on alternately. This is not only true of the present species, but of others also like *Paracarupira chiltoni* Campb. or *Eduardasina tillyardi* Tonn.

An explanation of this dimorphism is not easy to conceive. I do not think there is any ecdysis of the larva between the two types of mandibles, as no other hard chitinous structures are changed in any way, also that would not account for the alternate change of shape. I suspect that the type 5a is the one of the



Fig. 5. Mandible of *N. nicholsoni*; a, at the end of one stage; b, at the beginning of the same stage.

unexpanded mandible which remains in that state a certain time after moulting, and takes by and by its definite shape, color and hardness; the mandible in its first type is apparently not very hard, only the two first great teeth are blackish, and it presents three parts, 1, 2, 3, that may correspond to the three parts, 1, 2, 3 of the plain hard mandible.

Second Larval Stage.—Average size 2 mm., differs but little from the full-grown larva; the antennae are one-jointed and there is only one filament as gill, it is short and points forward; the 4 anal filaments are all of the same length. The spines on the side of the body are less numerous, especially on the cephalic division on which there are only 2 or 3 anteriorly and 2 posteriorly; on the anterior border of the main divisions there are 4 to 6 spines, and on the posterior one about 2 on each side; on the other hand the lateral appendages present the same number of spines as the adult larva.

Third Larval Stage.—Average size 3.5 mm., very near the preceding one from which it differs by the antennae with 2 joints, the gills with 3 filaments, two pointing forward and one backward, and by the more numerous spines on the sides of the body.

The larvae of *N. nicholsoni* have been found by Mr. Nicholson last year in great number on the surface rocks of a waterfall of Digger's Creek on Mt. Kosciusko on the 7th of December; the pupae were equally numerous.

Apistomyia tonnoiri, Till.

In the material collected by Mr. Nicholson, I find also some early stages of *A. tonnoiri* that I refer to the second and third ones.

Second Larval Stage.—Size 1.9 mm. The sculpture of the body is very inconspicuous; the spinules on the side are small and few in number; the sides of the main divisions are rounded, not angular. The antennae are two-segmented, the first segment being about one-third of the second in length. Second pair of lateral appendages of the anal division (those of the 8th abdominal segment) only represented by a pair of bristles. Gills formed of one single tube pointing forward.

Third Larval Stage.—Size 3 mm. Directly after moulting the larva with its unexpanded skin has a very spinulous appearance, its colour is then much darker, nearly black, and it could then be taken for the larva of some other species; but by and by this spiny sculpture disappears as the skin expands, and the colour becomes lighter. This occurs also at the beginning of the next stage. The spinules are still fewer in number than in the full-grown larva; the first segment of the antennae is now relatively larger, two-thirds of the second in length. The lateral appendages of the 8th abdominal segment are present in the form of very small callus with two curved bristles. The gills are composed of three filaments, two pointing forward and the other backward.